DOCUMENT RESUME

ED 080 376 SE 016 642

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TITLE Advanced Botany (Sahuarita High School Career Curriculum Project].
INSTITUTION Sahuarita High School District 130, Ariz.
PUB DATE [73]
NOTE 19p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Biology; *Botany; Curriculum; *Curriculum Guides; Instructional Materials; Science Activities; Science Education; *Science Units; *Secondary School Science; *Teacher Developed Materials

ABSTRACT

This course entitled "Advanced Botany" is one of a series of instructional guides prepared by teachers for the Sahuarita High School (Arizona) Career Curriculum Project. It consists of three units of study, and eight behavioral objectives relating to these units are stated. The topics covered include plant cells and taxonomy, functions and structures of plants, and plant growth and development. The units provide a statement of the rationale, objectives, sources of information, and a series of student activities. For related units in this series see SE 016 635 - SE 016 644. (JR)

SAHUARITA HIGH SCHOOL

CAREER

CURRICULUM

PROJECT

COURSE TITLE: ADVANCED BOTANY

UNIT TITLE: ADVANCED BIOLOGY - UNIT I

BY

ROBERT ESSER

Objectives

1. Be able to name and tell the function of a generalized plant cell with at least 90% accuracy.

2. Using a microscope, set up a slide and identify six different cells in the stem of a tracherphyte with 100% accuracy.

3. Identify seven phylums of plants from specimens in the lab with 100% accuracy.

4. Be able to name and write the function of these major plant parts: Leaves, stem, roots, flowers, spores, seed.

5. Describe the internal cell structure of the above plant parts and how they interelate in keeping the total plant functioning.

6. Write a report on the different needs for growht of a bean or tomato plant and that of a musroom from your study of their growth in class.

7. Be able to discuss the skills, job requirements, and locations where they may be obtained of at least two careers in the field of botany.

8. Describe the differences, similarities between asexual, and sexual reproduction in Moss, Gynosperms, Angipsperms, and Chlamydonas (Algae).

ADVANCED BOTANY

I. This course will be a study in more detail than the first botany course. We will cover Anatomy and Physiology of plants along with experiments in plant growth and development.

One of the chemical processes that takes place in most mammal's liver cells involve CO_2 and a cell chemical called triphosphoridine nucleotide. This chemical reaction takes many steps and with the help of ATP forces hydrogen into carbons coming out with a compound that has a ration of 2 hydrogen and 1 oxygen for each carbon atom. This of course is a carbohydrate.

Plants that have chlorophyll of course are experts in carbohydrate production. These plants are autotrophs for they are able to synthesize their own food. Man and most other organisms are heterotrophs which means they must take in organic compounds in order to produce them. In other words, green plants are self feeders and the other organisms are dependent feeders. In this course we hope to learn the why, when, and where, if not who.

II. Careers studied for this course will generally need college preparation These cover a wide range of employment from agriculture to health careers.

III. Units in this course are:

Unit I: Plant Cells and Taxonomy

Labs on Plant cells, diffusion, differenciation

Unit II: Functions and Structures of Plants

Labs on seed structure and enzyme actions

Unit III: Plant Growth and Development

Labs on Plant Hormone and Chonotography

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COURSE TITLE: ADVANCED BOTANY

UNIT TITLE: PLANT CELLS AND TAXONOMY - UNIT I

BY

ROBERT ESSER

UNIT I

PLANT CELLS AND TAXONOMY

RATIONAL:

The plants and animals with which we are familiar are made or composed of extremely large numbers of cells. These cells vary a great deal depending on their function and the type of organism they are in. We will study a few phylums of plants and their cell structures this quarter along with some of the occupations needing these basic skills.

OBJECTIVES

1. Be able to name and tell the function of a generalized plant cell with at least 90% accuracy.

2. Using a microscope, set up a slide and identify six different cells in the stem of a tracheophyte with 100% accuracy.

3. Identify seven phylums of plants from specimens in the lab with 100% accuracy.

INFORMATION SOURCES AND ACTIVITIES

1. Copy Key Card for Plant Cell using Plant cell model. Study the parts of the cell until you know them.

2. Using resource books in the bookshelf write out the function for parts of the plant cell. Some of these are Life an Introduction to Biology beginning on page 70, Cell Biology, a book of readings, General Botany, your basic sources, and

3. Lab I on plant cell structure:

Using provided vials of precut unstained stem tissues which are ready for you to use with the microscope.

The staining will bring out various parts of the specimen. Some structures will take a certain stain, others to a lesser degree, and some may not take a particular stain at all. There are many different stains and complicated techniques used by scientists. The procedure you will follow is not that of a research botanist, but a simple introductory technique.

Procedure for X sections:

Each student should remove a section of tissue from a watch glass or Syracuse dish (if there are none, empty contents of a vial into watch glass). Using a transfer brush, place section on slide then add a drop or two of defferential stain on the tissue. Wait 2 minutes and then carefully wash tissue with water using an eyedropper and holding sample down with a transfer brush. Pour off excess water and mount using a drop of glycerine, this will provide better results than a regular wet mount and will prevent drying out while you are studying it under the microscope.

Procedure for macerated stem tissues:

These tissues have been separated by both chemical and mechanical methods to show these different cells, trocheids, cork cells, porenchyme colleinchyma, sieve tubes, fibers, vessels, and companion cells.

From a beaker marked macerated stem tissue, place a drop on a slide and observe in a microscope. Draw an example of each as you see it in the microscope.

4. Using labeled materials in the classroom, study these phylums using microscopic and macroscopic observations. Write down in your notebook the difference between phylums from your own observations.

Here is a general list of phylums and their characteristics:

Chlorophyta - Green Algae

Single cells, filaments, ribbons, sheets, tubes, or irregular masses. Chlorophyll seldom masked by other pigments. Food usually stored as starch. About 6000 species.

Chrysophyta - Golden Algae
Mostly microscopic. Many with shells of silica. Chlorophyll usually masked by yellow pigments. Food often stored as oil. About 5700 species.

Phaeophyta - Brown Algae
Almost all macroscopic and marine. Chlorophyll usually masked by brownish piegments Food stored as carbohydrates, but not as starch. About 1000 species.

Rhodophyta - Red Algae
Mostly microscopic and marine. Chlorophyll usually masked by red pigments. Complex life histories. Reproductive cells not capable of locomotion. Food stored as carbohydrates, but not as starch. About 2500 species.

Mycophyta - Fungi
No chlorophyll. No vascular tissues. Structure primarily a system of threadlike cell groups - hyphae. Mostly saprovores, but many are parasitic on plants or animals. About 75,000 species.

Bryophyta - Bryophytes
Small (less than 40 cm tall). Mostly terrestrial. Often bear structures resembling stems and leaves, but lack vascular (conducting) tissue. Well-developed alternation of generations; the gametophyte generation is the more comspicuous, with the sporophyte more or less dependent upon it. About 24,000 species.

Tracheophyta - Vascular Plants
Vascular (conducting) tissue always present. Alternation of generations; sporophytes conspicuous; gametophytes much reduced (often microscopic) and in many cases dependent upon sporophytes. About 211,900 species.

5. Take notes using flim strips.

1. Bryophytes
2. Algae
3. Fungi Slime Molds
4. Gymnosperms
5. Monocotyledons
6. Dicotyledon
7. Feorns and feorn allies.

SAHUARITA HIGH SCHOOL

CAREER

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PROJECT

COURSE TITLE: ADVANCED BOTANY

UNIT TITLE: FUNCTION AND STRUCTURE OF PLANTS

BY

ROBERT ESSER

ADVANCED BIOLOGY - BOTANY

UNIT II - FUNCTION AND STRUCTURE OF PLANTS

RATIONALE

We have seen cell differenciations in the last unit. This should lead you to the idea that these specialized cells would be in different structure of a plant and would perform the different functions of life necessary for the plant to live in its environment.

In this unit we will study the major structure of plants in the classroom and on field trips. This will show the differences in plants and their specialized structures for survival.

Careers involved with the study of plants are many and varied. Here are a few:

Forester	Seed analyst
Horticulturist	Research Botanist
Landscaping	Farmer
Range Manager	Plant consultant

Objectives

1. Be able to name and write the function of these major plant parts: Leaves, stem, roots, flowers, spores, seed.
2. Describe the internal cell structure of the above plant parts and how they interelate in keeping the total plant functioning.
3. Write a report on the fifferent needs for growth of a bean or tomato plant and that of a mushroom from your study of their growth in class.
4. Be able to discuss the skills, job requirements, and locations

where they may be obtained of at least two careers in the field of botany.

Information Sources

1. Books - (a) Life, (b) Design for Life, (c) Green Version, (d) General Botany College Outline Series. These are in the reference shelf.

   School Library.

Activities

1. Using prepared microscope slides find these parts of a leaf (1) cuticle, (2) upper epidermis, (3) palisade layer, (4) spongy layer, (5) vein, (6) Stomate, (7) lower epidermis,
2. Making your own slide, find in the bean leaf: (1) stomates, (2) epidermis cells, (3) veins.
3. Using the Elodea leaves find the chloroplasts in their cells.
4. Using prepared slides, find the (1) epidermis, (2) cortex, (3) cambium, (4) pith, (5) phloem, (6) zylem.
5. Draw and describe the function of these parts of a root: (1) root cap, (2) Embryonic tissue, (3) epidermis, (4) phloem, (5)cambium, (6) xylem.
6. Lab: Seed structure and Enzyme Action
   In this lab you must first learn the parts of a seed. We will use two examples; Corn as a Monocot and the bean as a dicot. (Draw and inlarge from lab picture).

A seed is made up of these parts:

I. Embryo, which is made up of (1) one or two cotyledons, (2) Plumule, (3) hypocotyle, (4) radicle, (5) coloplile and coloriza in monocots.

II. Seed Coat or Coats.

III. Endosperm more common in monocots than dicots.

General Background

A seed has many features, both external and internal. This brief writing is to give you some background before start the lab.

Seed coats develop from the integuments of the ovule. If more than one seed coat is present, the inner seed coat, called a tegmen, is usually very thin and the outside one, the testa, is thicker and stronger in order to protect the inner part of the seed. The main outside features of the seed are micropile, raphe, and hilum. The scar where the seed tore away from the finiculus or stalk inside the flower is called the hilum. This may be easily seen in the bean but may be difficult in other kinds of seeds. In plants like the bean where the ovule becomes curved in development so that the micropile (which is a small opening in the seed) lies close to the hilum, there may be a ridge called the raphe. In seeds which mature without an endosperm, the endosperm is used up by the developing embryo before the seed is fully developed. This happens in the bean and most of the dicots. Examples of plants which have large food storing endosperms are corn, castor oil seed and most monocots.

Here is a list of the parts of the embryo plant and what they are:

1. plumule - first leaves when plant starts to frow
2. cotyledon - seed leaves used for food storage
3. hypocotyl - embryonic stem
4. radicle - embryonic root

Procedure:

Plant two bean and two corn seeds in small green pots using peat or vermiculite. Water and keep damp--not wet (ask if you do not know the difference). Then observe and keep records of what happens until they are about 4 in. high.

As soon as you have planted the seed, take a bean and corn seed, wrap in wet paper towel, and place in petri dish. Tape the petri dish shut and put your initials on it. You will use these seeds tomorrow to find seed parts.

Seeds that have been wet 24 hours:

Step 1. Find the hilum in the lima bean. Note the micropile through which the pollen tube entered the ovule.

Step 2. Now remove the testa by rolling the seed between your fingers. Carefully split the two cotyledons, making sure not to break up the embryo.

Step 3. Scrape the durface of a cotyledon place it on a slide and draw what you see.

Step 4. Scrape the cotyledon again and test for starch by placing a drop of iodine on the scrapings. So not scrape the cotyledon with the embryo on it.

Step 5. With a disecting scope look at the embryo of the bean and find the plumule, hypocotyl, radicle (the part of the embryo called the epicotyl is located at the point of joining of the plumules to the rest of the embryo.

Step 6. Take the soaked grain of corn. Look at the top of the kernels and see the silk scar. (The silk is actually the style of the pistle). Since this is a monocot the corn grain will ro

split into two parts, but if you will note the window like area on the one side of the corn grain, inside of this lies the embryo. Using a razor blade, cut thrcugh the window and seed the long way. Using the disecting scope find the parts of the corn grain.

Step 7. Place a drop of iodine on one of the cut surfaces of the corn grain and observe what happens. Explain your observations.

Step 8. Scrape the other corn grain (not stained) and check for starch grains of the lima bean under the microscope.

Step 9. Get a potato and cut it half. See if there is any difference in potato starch and the others.

Activity 7: Listen and take notes on lectures covering:

1. Plant cells
2. Plant parts and functions
3. Seeds and fruits
4. Flowers

Activity 8: Lab on Flower Parts.

Step 1. Get one flower and observe whether your flower is complete or incomplete and perfect or imperfect.

Step 2. Dissect the flower, finding and laying out each of these parts: Petal, sepal, stamen, pollen (under microscope), pistle, ovule.

Step 3. Have your disection and layout checked by instructor.

Activity 9: Field trip on the school grounds. Get guide from instructor and follow its instructions.

Activity 10: Using the mushroom growing kit and the library study the requirements for development and growth of the mushroom.

Activity 11: Study and see the parts of the mushroom: pilus, gills, annulus, stipe, mycelium, spores (if present).

Activity 12: Take final test for unit and turn in all assignments for your unit grade.

SAHUARITA HIGH SCHOOL

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PROJECT

COURSE TITLE: ADVANCED BOTANY

UNIT III: PLANT REPRODUCTION, GROWTH AND DEVELOPMENT

BY

LARRY CHRISTENSEN AND ROBERT ESSER

UNIT III ADVANCED BOTANY

PLANT REPRODUCTION, GROWTH AND DEVELOPMENT

Reproduction in plants is varied and has adapted to the needs of a great varity of living forms. As you have already learned the three main ways a plant may reproduce are (1) sexual, (2) asexual by spores, or (3) vegetative. Of the three, sexual reproduction is considered a great advantage over the others for survival of the species. This is because it allows for a mixing of genes and a greater amount of variance within a single population; therefore if a change did occure in the environment, the sexual reproducing group should have a greater chance to adapt to it. For the asexual method does not have the ability to mix genes into new combinations.

All groups of organixms at least at the phylum level have sex. This was not believed true a few years ago; but with improved research techniques, even Bacteria and viruses have shown combinations of traits.

OBJECTIVES AND ACTIVITIES

1. Describe the differences, similarities between asexual, and sexual reproduction in Moss, Gynosperms, Angiosperms, and Chlamydonas (Algae).

ACTIVITIES 1.1

Plant two different angiosperms at least three of each variety. Using materials available in lab or your own.

ACTIVITY 1.2

Check the moss in the growing area and start your own culture following the information at the culture. Observe and write a paper on the stage of reproduction with your own drawings.

ACTIVITY 1.3

Read materials on plant reproduction available in the room and the library and answer the questions on the sheet you are given. (You will be in groups of 3 and all will have different questions in order to participate in these small group descussions.)

OBJECTIVE 2.1

Be able to write the needs of plants for their growth and development (the plants you planted in Activity 1.1).

ACTIVITY 2.1

Take one plant and place it in a light tight cabinet for 5 day. Take another of the same species and place it on the

growing tray.

Observations taken and recorded are:

1. Total height of plant.
2. Number of leaves
3. Color and general appearance of plant.

This is done on days 1 and 5.

Now keep each plant watered the same and all other environmental factors the same.

Now write a Brief Conclusion on your observations.

ACTIVITY 2.2

Take two of the other plants of a different species and leach their soil with distilled water, three times. (to remove nutrients you have added previously.)

(b) Take any pair of prepared solutions. Keep their soil moist with it and observe results over a three week time.

Record any changes in your plants and compare with the plants you have left as control.

Have results ready for instructor at the end of this time.

ACTIVITY 3

Show the ability to isolate Chlamydonas and pair group A and B. Using a microscope, watch the results. Have instructor check your microscope after you have it set up.